

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

PCM0035 – GENERAL CHEMISTRY

(Foundation in Engineering)

13 OCTOBER 2018

2.30 p.m – 4.30 p.m

(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 3 pages with 3 Questions only, excluding the cover page.
2. Attempt **ALL** questions. Distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

QUESTION 1 [20 MARKS]

(a) Sketch the orbital diagrams for the following atom or ion.

- (i) Cr^{2+} [1 mark]
(ii) Cu [1 mark]
(iii) Cl [1 mark]

[Atomic number: Cr = 24; Cu = 29; Cl = 17]

(b) Determine if the following combinations of quantum numbers (n , l , m_l , m_s) are acceptable. Explain your answer if the combination of quantum numbers is unacceptable.

- (i) (3, 3, 2, $+\frac{1}{2}$)
(ii) (3, 0, 0, $+\frac{1}{2}$)
(iii) (4, 2, -3, $+\frac{1}{2}$)
(iv) (3, 2, -1, $-\frac{1}{2}$)

[4 marks]

(c) For the following pairs of ions, identify the ion with smaller ionic radius. Explain your answer.

- (i) Cl^- or Br^- [1½ marks]
(ii) Na^+ or Al^{3+} [1½ marks]

[Atomic number: Cl = 17; Br = 35; Na = 11; Al = 13]

(d) Bonding is a result from combining a minimum of two types of atoms. State the type of bonding (ionic, covalent or metallic) in the following compounds.

- (i) $\text{K}(s)$ [1 mark]
(ii) $\text{N}_2\text{O}(g)$ [1 mark]
(iii) $\text{MgCl}(s)$ [1 mark]

[Atomic number: K = 19; N = 7; O = 8; Mg = 12; Cl = 17]

(e) Draw the *Lewis structures* for

- (i) As [1 mark]
(ii) Se [1 mark]
(iii) NO_2^- [2 marks]

[Atomic number: As = 33; Se = 34]

(f) Use the VSEPR model to predict the geometry and give the AB_mE_n classification for OF_2 . Provide the *Lewis structure* for this molecule.

[Atomic number: F = 9] [3 marks]

Continued...

QUESTION 2 [15 MARKS]

(a) Define *phase change*. [1 mark]

(b) What processes are involved with the phase changes if

(i) I₂ vapor comes in contact with a cold surface? [1 mark]

(ii) solid vaporized directly? [1 mark]

(iii) dew appears on a grass in the morning? [1 mark]

(c) (i) What is the difference between the intermolecular forces and intramolecular forces? [1 mark]

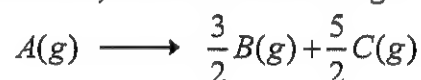
(ii) Determine the possible types of crystal for the following compounds:

ZnS, SO₂, CaF₂, Ba and SiO₂.

[2½ marks]

[Atomic number: Zn = 30; S = 16; O = 8; Ca = 20; F = 9; Ba = 56; Si = 14]

(d) Referring to the reaction below, answer the following.



(i) Express the rate of reaction in term of changing in concentration of each of the reactants and products. [1½ marks]

(ii) What is the rate of *C* if the rate of *B* is increasing at 0.025 M/s? [1½ marks]

(iii) What is the reaction order if the rate law for $A(g) = k[A]^{2/3}$? [1 mark]

(iv) If the rate constant *k* is $6.60 \times 10^{-2} \text{ min}^{-1}$, determine the half-life of this decomposition. [1 mark]

(e) Sometimes catalyst is preferred to be used in the reaction.

(i) What is catalyst? [1 mark]

(ii) What are the types of catalyst? Briefly discuss the difference between them. [1½ marks]

Continued...

QUESTION 3 [15 MARKS]

- (a) Acids and bases are classified in terms of their formulas and their behavior in solvent water (based on Arrhenius definition).

- (i) What is the main characteristic of acids? [1 mark]
(ii) What is the main characteristic of bases? [1 mark]

- (b) Write the acid-dissociated constant (K_a) for the following acids.

- (i) HNO_2 [½ mark]
(ii) HCO_3 [½ mark]

- (c) Calculate the pH of (i) and (ii), and pOH of (iii).

- (i) $5.04 \times 10^{-3} \text{ M HI}$ [½ mark]
(ii) 0.0111 M NaOH [1 mark]
(iii) 0.125 M Ba(OH)_2 [½ mark]

- (d) Rank the following acids in the order of decreasing acid strength (Higher strength first):

HCl HI HBr HF

[2½ marks]

- (e) Define the following.

- (i) Redox reaction [1 mark]
(ii) Electrochemistry [1 mark]

- (f) Consider the electrolysis of molten barium chloride, BaCl_2 .

- (i) Write the balanced half-reactions at cathode and anode. [2 marks]

- (ii) How many grams of Ba metal can be produced by supplying 0.50 A for 30 min?

[3½ marks]

[Atomic mass of Ba = 137.3 ; Faraday constant = 96,500 C/mol e^-]

End of Paper